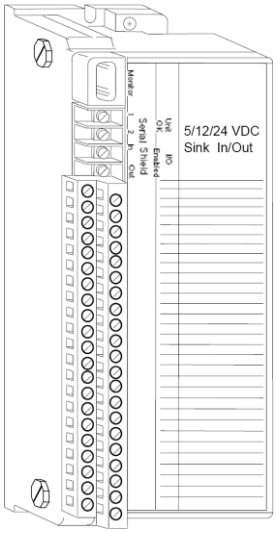
# DC 32-Circuit Source/Sink I/O Blocks

June 2014 GFK-0044H

## Description

A DC 32-Circuit Source/Sink I/O Block is an intelligent, configurable module that interfaces the controller to devices that provide or accept a binary signal. The blocks are compatible with a wide range of input devices, including both 2-wire and 3-wire electronic proximity switches. Outputs may be low-power control and indicating devices such as relays, contactors, and lamps. Four models are available:

- **12/24 Vdc 32-Circuit Source blocks** (IC66*BBD024, BRD024), which provide current to field output devices.
- **5/12/24 Vdc 32-Circuit Sink blocks** (IC66*BBD025, BRD025), which receive current from field output devices.




**Note: IC66*BRD024 & IC66*BRD025** contain blocking diodes and feedback resistors for specific redundancy applications (see pg 2).

***Features***

- Source and Sink versions operate at nominal 12 to 24Vdc
- Sink version is also +5 volt TTL-compatible
- Thirty-two configurable I/O circuits, inputs and outputs can be mixed on block
- Resettable self-protecting circuits
- Software configurable
- Advanced diagnostics
- Short circuit protection
- Failed Switch detection

These blocks have 32 identical discrete I/O circuits, each easily configured to be an input, an output, or an output with feedback. This flexibility provides maximum design and application efficiency.

Each circuit contains built-in protection when used as an output, protecting the driver while allowing short-time surges. It also protects against shorted loads caused by wiring errors.

Block LEDs verify proper block operation and CPU communications. Individual circuit LEDs on the logic side indicate voltage present on inputs and outputs.

## Specifications

| Catalog Numbers | Standard Block | GMR Block |
|---|---|---|
| 32-Circuit 12/24 Vdc Source I/O Block | IC66*BBD024 | IC66*BRD024 |
| Terminal Assembly | IC66*TBD024 | IC66*TBD024 |
| Electronics Assembly | IC66*EBD024 | IC66*ERD024 |
| 32-Circuit 5/12/24 Vdc TTL Sink I/O Block | IC66*BBD025 | IC66*BRD025 |
| Terminal Assembly | IC66*TBD025 | IC66*TBD025 |
| Electronics Assembly | IC66*EBD025 | IC66*ERD025 |

| Block Specifications | | |
|---|---|---|
| Size (height x width x depth) | 8.83" x 3.58" x 4.7" (22.43 x 9.1 x 11.94 cm) | |
| Weight | 4 lbs. (1.8 kg) | |
| LEDs (I/O Block) | Unit OK, I/O Enabled | |
| LEDs (each circuit) | Individual logic side indicators | |
| Block to block Isolation | 850V | |
| Heat Dissipation with 8 inputs | 11W minimum | 13W minimum |
| Heat Dissipation with 32 outputs at 0.5 Amp | 18W maximum | 22W maximum |
| Operating voltage (one source) | 10 to 30 Vdc (12/24 V supply)<br>4.9 to 5.3 Vdc (5 V supply) (sink only)<br>absolute instantaneous limit | |
| Ripple (maximum) | 10% (12/24 volts) , 1% (5 volts) | |
| Required DC power | 150 mA typical/300 mA maximum | |
| Power supply dropout time | 4ms at 12 volts, 20ms at 24 volts | |

| Input Specifications | | | |
|---|---|---|---|
| Input voltage relative to DC- | | Source Blocks | Sink Blocks |
| Input ON | 5 Vdc supply | not applicable | 0-0.8 Vdc |
| | 12 Vdc supply | 8-12 Vdc | 0-4 Vdc |
| | 24 Vdc supply | 18-24 Vdc | 0-6 Vdc |
| Input OFF | 5 Vdc supply | not applicable | 2-5 Vdc |
| | 12 Vdc supply | 0-6 Vdc | 6-12 Vdc |
| | 24 Vdc supply | 0-12 Vdc | 12-24 Vdc |
| Input impedance (typical) | | 3.3KΩ | |
| Input processing time (typical) | | 1.4ms (plus selectable filter delay) | |
| Selectable input filter times | | 1, 2, 3, 4, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, or 100ms | |

| Output Specifications | |
|---|---|
| Maximum output current (steady state) | 0.5 Amps per circuit |
| Maximum inrush current | 4 Amps up to 10ms (once every .5 sec. maximum) |
| Block output current (total) | 16 Amps |
| Output OFF leakage current | 10µA, maximum |
| Output turn-on delay | 0.5ms, maximum |
| Output voltage drop | 4.0 volts maximum at 4 Amps inrush |
| Output Diagnostics | Switch Fault |

| Environmental Specifications | |
|---|---|
| Operating Temperature | -0°C to +60°C (32°F to +140°F) |
| Storage Temperature | -40°C to 100°C (-40°F to +212°F) |
| Humidity | 5% to 95% (non-condensing) |
| Vibration | 5-10 Hz 0.2" (5.08mm) displacement,<br>10-200 Hz at 1G |

Refer to GFK-0867 for product standards and general specifications.

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## Using this Datasheet

This datasheet summarizes information about block installation, configuration, and diagnostics.

Your primary reference should be the *Discrete and Analog Blocks User's Manual GEK-90486-2*. It includes detailed instructions for block installation and configuration.

For information about systems and communications, including bus specifications, refer to the *I/O System and Communications Manual GEK-90486-1*.

## Compatibility

These blocks are compatible with Hand-held Monitor model IC66*HHM501 only. Note that Hand-held Monitor IC66*HHM501 version A (an older version) will only display all references for a 32-circuit block if it is made the "Active Block."

For an IC600 series PLC, the Bus Controller may be model IC66*CBB902 or CBB 903, any version; or model IC66*CBB900 or CBB901 version 1.3 or later.

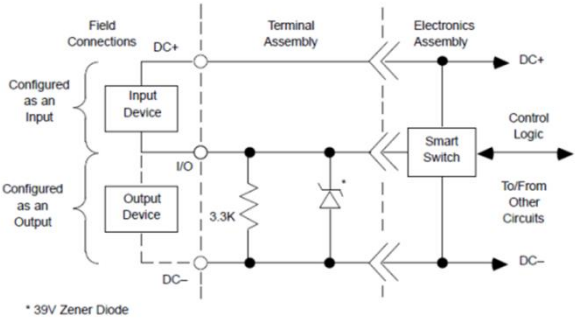
If used to control operation of a Bus Switching Module, BSM IC66*BSM021 is required. The block must operate at 18 volts or above.

## Block Operation

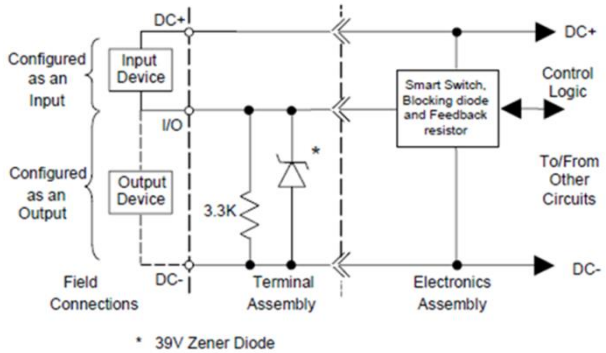
These blocks provide 32 identical circuits, each configurable as an input or output. For both types of blocks, output circuits can be directly connected to input circuits without the use of other components or inversion of logic states.

### *32-Circuit DC Source I/O Blocks*

A DC source block has all output devices connected to the negative (-) side of the power supply. Inputs control the positive (+) side. For outputs, an ON condition is logic 1 and an OFF condition is a logic 0.

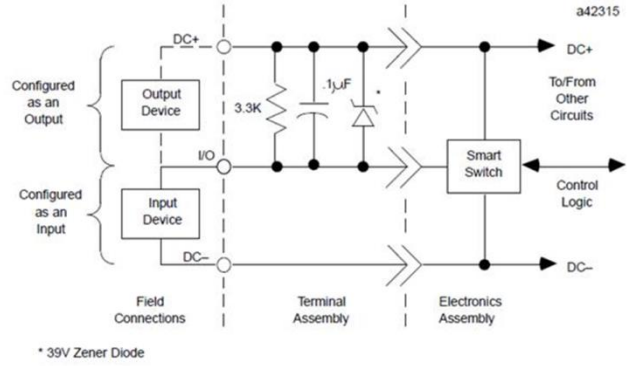



**For IC66* BRD024 only:**

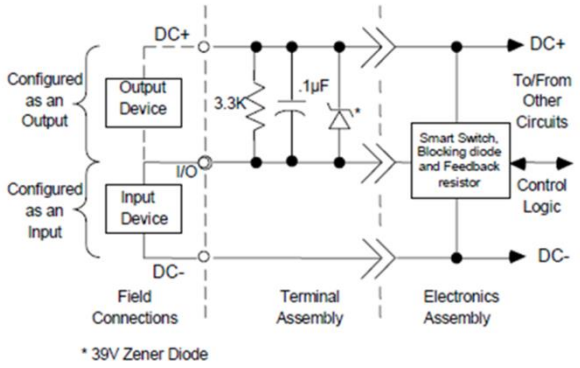



### *32-Circuit DC Sink I/O Blocks*

A DC sink block has all output devices externally connected to the positive (+) side of the power supply. Inputs control the negative (-) side. For outputs, an ON condition is logic 0 and an OFF condition is a logic 1.




**For IC66* BRD025 only:**



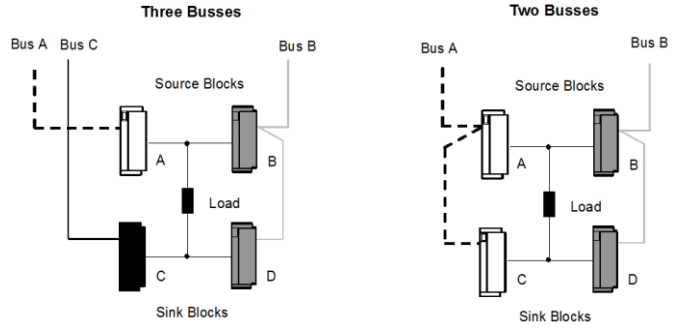

## Redundancy Wiring (for IC66*BRD* only)

### *Blocking Diodes and Feedback Resistors for Redundancy*

Each I/O point on these blocks has a blocking diode and feedback resistor that facilitate redundancy when two or four points, each from a different block, are used to drive the same load in a GMR T-output group or GMR H-output group. For details about GMR, see *GMR User's Manual* GFK-1277. Below is an example of a GMR H-output group.

### *GMR 2-Block T and 4-Block H Output Groups*

An H-output group consists of two *BRD024 blocks connected in parallel on one side of the load, and two *BRD025 blocks connected in parallel to the other side of the load. Note the assignment of the communications busses.



## LEDs

The block's Unit OK and I/O Enabled LEDs show its operating status:

| Unit OK | I/O Enabled | Meaning |
|---|---|---|
| ON | ON | Block functioning, CPU communicating |
| ON | OFF | Block functioning, No CPU communications for 3 bus scans |
| ON | Blinking | Block functioning, Circuit forced |
| Blinking | ON | Circuit fault, CPU communicating |
| Blinking | OFF | Circuit fault, No CPU communications for 3 bus scans |
| Alternate Blinking | | Circuit fault, Circuit forced |
| Synchronous Blinking | | No CPU communications - block number conflict |
| OFF | OFF | No block power, or block faulty |

Each circuit has its own LED. If the circuit is configured as an input, the LED indicates the presence of threshold voltage at the input terminal. If the circuit is configured as an output, the LED indicates the actual state of the load.

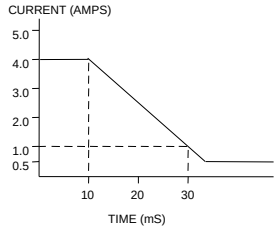
## Diagnostics

The block monitors outputs for overload conditions, and checks the actual state of the switch against the commanded state. In case of **overload** or wrong switch state, the block reports: FAILED SWITCH.

**Short Circuit/Overcurrent Protection:** diagnostics protect individual output circuits against excess current. For Source blocks, the load usually gets short-circuited to the DC- side of the supply. For Sink blocks, the load usually gets short-circuited to the DC+ side.

If the output is commanded to go on and current exceeds 5 Amps for 1ms, the circuit is automatically turned off and the FAILED SWITCH message issued. The circuit must be reset by cycling power to the block, or by sending a CLEAR FAULTS command from the Hand-held Monitor or the Bus Controller.

**Surge Currents:** Both Source and Sink blocks handle steady-state loads of 0.5 Amps during normal operation. Surge current protection determines conditions for safely switching loads between 0.5 Amps and 4 Amps. The following chart shows allowable surge transients.




**CAUTION**

**Failure to operate a circuit within these limits may result in thermal overload and damage to the block**

## Configuration

Each block must be configured with a Hand-Held Monitor to:

- Enter its Device Number (serial bus address).
- Enter its Reference Number (required only for IC600 and IC550 series PLCs only).

In addition, unless all circuits on the block will be inputs, the Block I/O Type must be set to either Outputs or Combination *on the Program Block ID screen*.

***Note:*** If a block is configured offline, it must be properly grounded and have a 75Ω resistor installed across its Serial 1 and Serial 2 terminals.

The rest of the features can be configured either using a Hand-held Monitor, or by sending a Write Configuration datagram to the block from the host.

| Feature | Circuit or Block | Factory Setting | Selections |
|---|---|---|---|
| Baud Rate | B | 153.6 std | 153.6 std, 153.6 ext, 76.8, 38.4 |
| Block I/O Type | B | input | input, output, combination |
| Pulse Test | B | enabled | enabled, disabled |
| Input Filter Time | B | 20ms | 1-100ms |
| Circuit I/O Type | C | input | input, output |
| Report Faults | C | yes | yes, no |
| Hold Last State | C | no | yes, no |
| Output Default State | C | off | on, off |
| BSM Present | B | no | yes, no |
| BSM Controller | B | no | yes, no |
| Output Timeout | B | 2.5 sec. | 2.5, 10 seconds |
| Redundancy Mode | B | none | none, standby, duplex, GMR |
| Duplex Def. State | B | off | on, off |
| Config. Protect | B | disabled | enabled, disabled |

## Installation Instructions

Carefully inspect all shipping containers for damage. If any equipment is damaged, notify the delivery service immediately. Save the damaged shipping container for inspection by the delivery service. After unpacking the equipment, record all serial numbers. Save the shipping containers and packing material in case it is necessary to transport or ship any part of the system.

### *Installation in Hazardous Locations*

The following information is for products bearing the UL (C-US) Hazardous Location, CE, and FM Class 1 Division 2 Group A, B, C & D approvals:

- THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS A, B, C, D OR NON-HAZARDOUS LOCATIONS ONLY.
- WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2;
- WARNING - EXPLOSION HAZARD - WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES; AND
- WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NONHAZARDOUS.
- THIS EQUIPMENT IS AN OPEN-TYPE DEVICE AND IS MEANT TO BE INSTALLED IN AN ENCLOSURE SUITABLE FOR THE ENVIRONMENT THAT IS ONLY ACCESSIBLE WITH THE USE OF A TOOL.

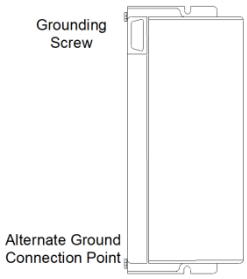
### *Block Mounting*

I/O blocks are considered "open equipment" and therefore must be installed within a protective enclosure. They should be located in an area that is clean and free of airborne contaminants. There should be adequate cooling airflow.

The block can be mounted right side up, or upside down. Leave at least 2 inches of space between blocks. Mount the block by drilling two screw or bolt holes for 8-32 hardware. Position the block so that the notches in the upper and lower flanges line up with the mounting holes. Mount the block using 8-32 screws. Use star washers to provide ground integrity.

### *Grounding*

The block's mounting screws must not be used as the only means of grounding the block. Connect the green ground screw on the block to a reliable ground system using a short wire lead, minimum size AWG #12 (avg. 3.3mm$^2$ in cross-section).

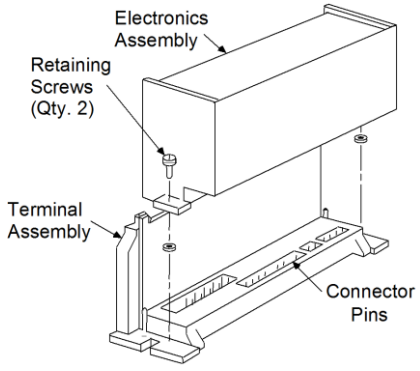



**WARNING**

**If mounting screws do not make good ground connection and the ground screw is not connected to a reliable ground, the block is not grounded. Electrical shock hazard exists. Death or personal injury may result.**

### *Removing an Electronics Assembly*

The block's Electronics Assembly can be replaced with a compatible model without removing field wiring or reconfiguring the block.




1. Unscrew the retaining screws at the top and bottom of the block.
2. Using a Block Puller (IC660BLM507), engage the tabs in the first vent slots. Move the tool to the center of the block and squeeze the handle.
3. Pull the Electronics Assembly upward.

**WARNING**

**If power is applied to the field terminals, power is also exposed on the connector pins at the base of the Terminal Assembly, and electrical shock hazard exists. Do not touch the connector pins! Death or injury may result.**

### *Inserting an Electronics Assembly*

1. Align the Electronics Assembly in the guides and push down firmly.

**CAUTION**

**Do not exert excessive force; it may damage the block.**

If unusual resistance is met, remove the Electronics Assembly. If power is applied to the block, DO NOT TOUCH THE CONNECTOR PINS! Inspect the Terminal Assembly, connector receptacle, and connector edge board (on the Electronics Assembly). Be sure the keying matches. Remove any obstacles and reinsert the Electronics Assembly. Pay close attention to the alignment of the guide pins.

2. Secure the Electronics Assembly with the screws on the top and bottom of the Terminal Assembly.

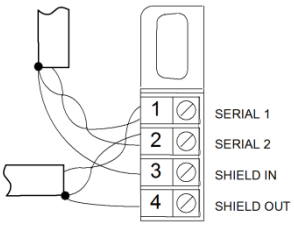
### *Serial Bus Wiring*

Do not over-torque the terminal screws. Recommended torque for all terminals is 6 in-lb. (0.678 Nm).

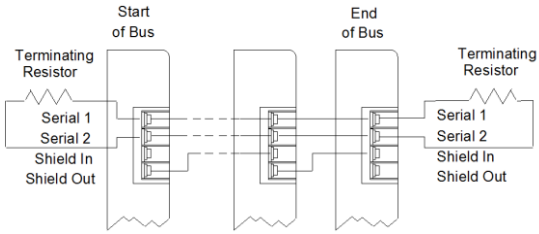
Terminals 1 to 4 are for the serial bus. They accept one AWG #12 wire (avg. 3.3mm$^2$ in cross-section) or two AWG #14 wires (each avg 2.1mm$^2$). The minimum recommended wire size is AWG #22 (avg 0.36mm$^2$).

Terminals 1 to 4 can also accommodate spade or ring lugs up to 0.27 inch (6.85 mm) in width with a minimum opening for a #6 screw, and up to 0.20 inch (5.1 mm) depth from the screw center to the back barrier. Be sure unshielded wire ends are not longer than 2 inches (5cm).

Using one of the cable types recommended in the System and Communications User's Manual, connect the serial bus to terminals 1- 4. (If a Bus Switching Module will be connected directly to the block, see below instead).




If the block is at either end of the bus, connect a terminating resistor of the appropriate type (see the *System and Communications User's Manual* for details) across its Serial 1 and Serial 2 terminals.




### *Wiring for a Bus Switching Module*

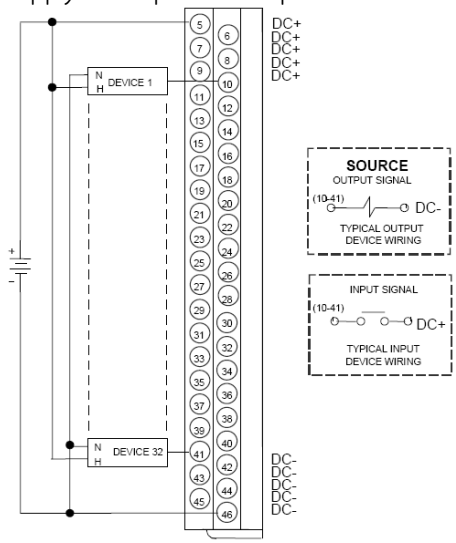
If the block will be a BSM Controller, attach the Bus Switching Module to the block's serial bus terminals. Attach the serial bus cables to the BSM as described in the Bus Switching Module datasheet. Wire the BSM like a load to circuit 1. Connect either BSM pigtail wire to terminal 6. For a DC Sink block, connect the other BSM wire to DC+. For a DC Source block, connect the other BSM wire to DC-.

**Field Wiring**

Any circuit can be an input or output. Connect one terminal of a field device to DC power and the other to the block (terminals 10-41). All I/O devices must return to the same power circuit.

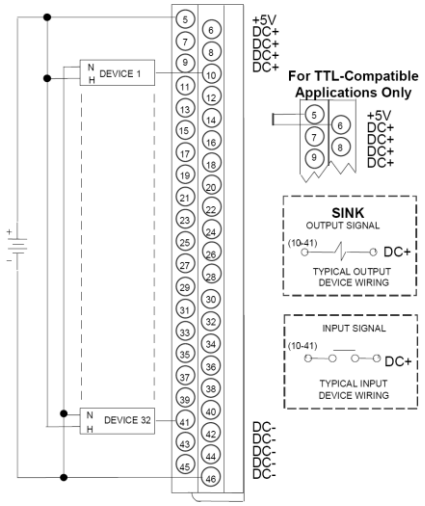
***Connections for a DC Source Block***

For a Source block, connect outputs to the negative side of the power supply and inputs to the positive side.




***Connections for a DC Sink Block***

For a Sink block, connect outputs to the positive side of the power supply and inputs to the negative side. Connect a DC source to the DC+ terminals (6-9) and the return to the DC- terminals (42-46).




For correct 5 volt operation, power to the block, measured at the power supply input terminals, must be within the range 4.9Vdc to 5.3Vdc.

**CAUTION**

**Do not apply more than 5.25 volts to the +5V terminal. Damage to the block may result.**

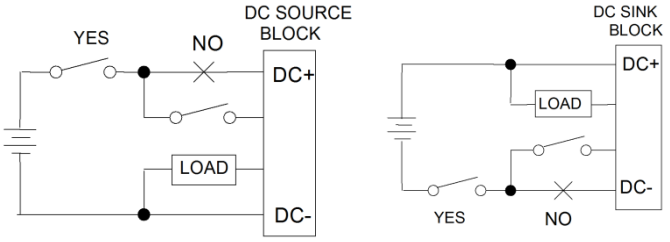
**For 5 volt Sink applications only**, jumper the +5V terminal to any DC+ terminal.

**CAUTION**

**For 12 or 24 volt sink applications do not jumper the +5V terminal to DC+. It will damage the block. Leave the +5V terminal open.**

***DC Source and Sink Block, Power Disconnects***

It is important to wire Block power disconnects so that power and input power will be removed at the same time. Locate the power disconnect as shown below.




**CAUTION**

**If circuit power is not removed at the same time as block power, the block may power up when multiple inputs are activated, even though one leg of power has been removed from the block.**

If you want to disable the block without removing power from input devices, use a Block Puller to unplug the Electronics Assembly. Do not disconnect H or N to remove power.

***Wire sizes***

Terminals 5 to 46 are for field devices. Each terminal accepts one AWG #14 wire (2.1mm$^2$ average cross section), two AWG #14 (2.1mm$^2$ cross section) solid wires, or two AWG #16 (1.3mm$^2$ average cross section) stranded wires.

***Bussing Power Connections***

Depending on layout and current loads, positive and negative connections can be bussed and made by single wires to the block or power source.